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Chemical composition of stellar populations in ω Centauri

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Abstract. We derive abundances of Fe, Na, O, α and s-elements from GIRAFFE@VLT spectra for more than 200 red giant stars in the Milky Way satellite ω Centauri. Our preliminary results are that: (*i*) we confirm that ω Centauri exibiths large star-to-star metallicity variation ($\sim$ 1.4 dex); (*ii*) the metallicity distribution reveals the presence of at least five stellar populations with different [Fe/H]; (*iii*) a distinct Na-O anticorrelation is clearly observed for the metal-poor and metal-intermediate stellar populations while apparently the anticorrelation disappears for the most metal rich populations. Interestingly the Na level grows with iron.

Keywords. Globular clusters, Stellar populations, Omega Centauri.

1. Introduction

Omega Centauri (ω Cen) is among the most studied and enigmatic Milky Way satellites. It has always been considered a Globular Cluster (GC), but a number of peculiarities, like the mass, the kinematics, and the complexity of its numerous populations identified by both spectroscopic and photometric investigations (Lee et al. 1999, Pancino et al. 2000, Bedin et al. 2004, Piotto et al. 2005, Villanova et al. 2007), suggest that it may be the remnant of a larger stellar system (Bekki & Norris 2006).

Recently, it has been shown that some peculiar features observed in ω Cen are shared with other GCs: A bimodality in s elements is present also in NGC 1851 (Yong et al. 2008) and M22 (Marino et al. 2009), and intrinsic variations in [Fe/H] were detected in M22 (Marino et al. 2009), and M54 (Sarajedini & Layden 1995; Bellazzini et al. 2008; Carretta et al., submitted to ApJL). However ω Cen still remains the most exceptional GC in the Milky Way as concerns its complex of numerous populations and large chemical variations.

Here we present preliminary results of our project aimed to characterize the evolutionary connections of the sub-populations in ω Cen, by studying their chemical content.

2. Observations and data reduction

We analysed FLAMES/GIRAFFE HR09 and HR13 spectra for a sample of more than 200 red giant stars. Abundances for iron are obtained from an equivalent width analysis by using the Local Thermodynamical Equilibrium program MOOG (C. Sneden, PhD thesis), while the other elements are measured by comparing observed spectra with synthetic ones. More details on the abundance measurements can be found in Marino et al. (2008, 2009).

3. Results

We obtained that the [Fe/H] ranges from ~ -2.1 to ~ -0.7 dex, with at least five distinct peaks in the iron distribution as shown in the left panel of Fig.1. In the right panel of Fig.1 we represent the Na and O abundances for the five sub-populations in ω Cen, selected on the basis of different iron content and their position on the color magnitude diagram (CMD). In lower panels the position on the B-$(B-R)$ CMD (Bellini et al. 2009) for the different selected groups is shown, with the corresponding NaO anticorrelation in each upper panel. We note that the NaO anticorrelation is well defined for the stars belonging to the metal intermediate populations (middle panels), and some hints of a probably less extended one are present for the more metal poor stars. Apparently the anticorrelation disappears for the most metal rich populations. Note that the Na level grows with iron.

From the analysis of the s elements La and Ba we derive that the s element abundance grows with increasing iron, and interstingly enough, in each group defined as in Fig.1, the s element apparently increase also with Na.

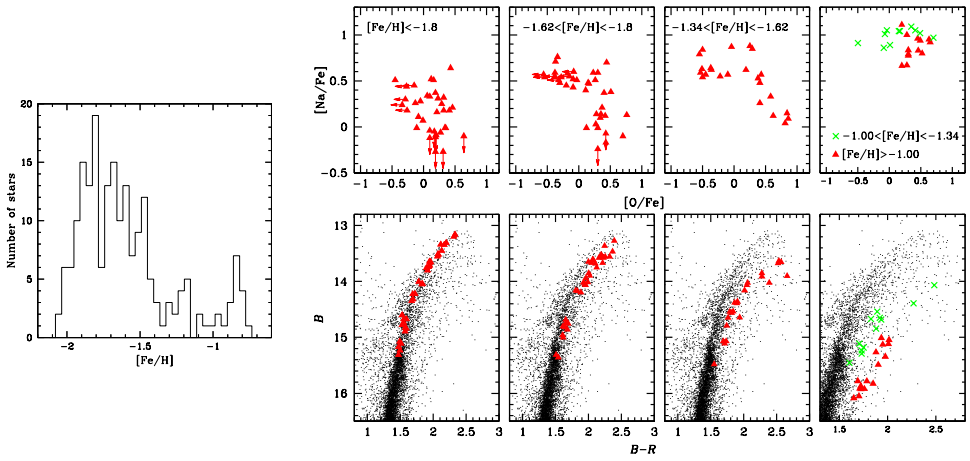

Figure 1. *Left panel*: Distribution of the iron content for our analysed sample. *Right panels*: Na-O anticorrelation for the different groups of stars selected on the basis of the iron content and the position on the CMD represented in lower panels.

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